

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau(43) International Publication Date  
20 January 2005 (20.01.2005)

PCT

(10) International Publication Number  
**WO 2005/005010 A2**(51) International Patent Classification<sup>7</sup>:**B01D**

(21) International Application Number:

PCT/US2004/004756

(22) International Filing Date: 18 February 2004 (18.02.2004)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

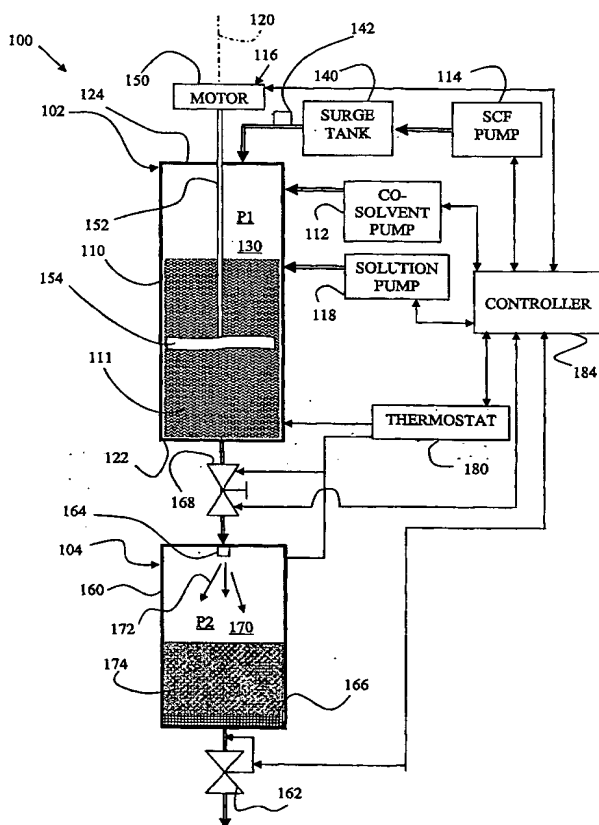
60/449,479

21 February 2003 (21.02.2003)

US

(71) Applicant: **FERRO CORPORATION** [US/US]; 1000  
Lakeside Avenue, Cleveland, OH 44114 (US).(72) Inventors: **SHEKUNOV, Boris, Y.**; 115 Woodland  
Trace, Aurora, OH 44202 (US). **CHATTOPADHYAY,**  
**Pratibhash;** 7729 C Oakhill Road, North Royalton, OH  
44133 (US). **SEITZINGER, Jeffrey, S.**; 314 Lazzaro  
Drive, Broadview Heights, OH 44147 (US).(74) Agent: **CLARK, Kenneth, A.**; Rankin, Hill, Porter &  
Clark LLP, 925 Euclid Avenue, Suite 700, Cleveland, OH  
44115-1405 (US).(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,  
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,  
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,  
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,  
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,  
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,  
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,  
ZW.(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), Euro-  
pean (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR,

[Continued on next page]

(54) Title: METHODS AND APPARATUS FOR PRODUCING COMPOSITE PARTICLES USING SUPERCRITICAL FLUID  
AS PLASTICIZING AND EXTRACTING AGENT

(57) Abstract: The present invention provides methods for producing composite particles using supercritical fluid as a plasticizing and extracting agent, composite particles formed in accordance with the methods and an apparatus for carrying out the methods. In accordance with the methods of the invention, a polymer, a wax and/or a lipid that is a solid at standard temperature and pressure is contacted with a supercritical fluid to form a melt, either before or after the polymer, wax and/or lipid has been contacted with a solution comprising a solute dissolved in a solvent. The supercritical fluid plasticizes the polymer, wax and/or lipid and extracts the solvent from the solution, resulting in the formation of a two-fraction system including a first melt-rich fraction that includes the plasticized melt and fine particles of precipitated solute that are dispersed in the melt, and a second fraction that includes the supercritical fluid and the solvent. Expansion of the first fraction across a pressure drop results in the formation of composite particles that include the polymer, wax and/or lipid and the solute.